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Redescription of Three Monotypic Genera of Amphisbaenians From South America: *Aulura* Barbour, *Bronia* Gray, and *Mesobaena* Mertens

BY CARL GANS¹

ABSTRACT

Three monospecific genera of Neotropical amphisbaenids, *Aulura*, *Bronia*, and *Mesobaena* are redescribed, based on all known available specimens. A key to all American genera of amphisbaenians is included.

Each form is considered a valid species, seemingly sufficiently discrete to justify the retention of the genus. Only for *Mesobaena* are sample size and field data sufficient to document geographical variation.

INTRODUCTION

The basins of the Amazon and Orinoco rivers include the seemingly restricted ranges of three monotypic amphisbaenian genera: *Bronia* Gray, 1865, *Aulura* Barbour, 1914, and *Mesobaena* Mertens, 1925. These species are of particular interest because they apparently represent intermediate levels of burrowing specialization, between the conditions shown in the generalized genus *Amphisbaena* and those respectively in the keel-snouted *Anops* (*Bronia*, *Mesobaena*) and the spade-snouted *Leposternon* (*Aulura*). In describing *Mesobaena*, Mertens (1925) also pointed to a similarity with the

¹ Research Associate, Department of Herpetology, the American Museum of Natural History; Professor of Biology, State University of New York at Buffalo. Present address: Department of Zoology, The University of Michigan, Ann Arbor, Michigan 48104.

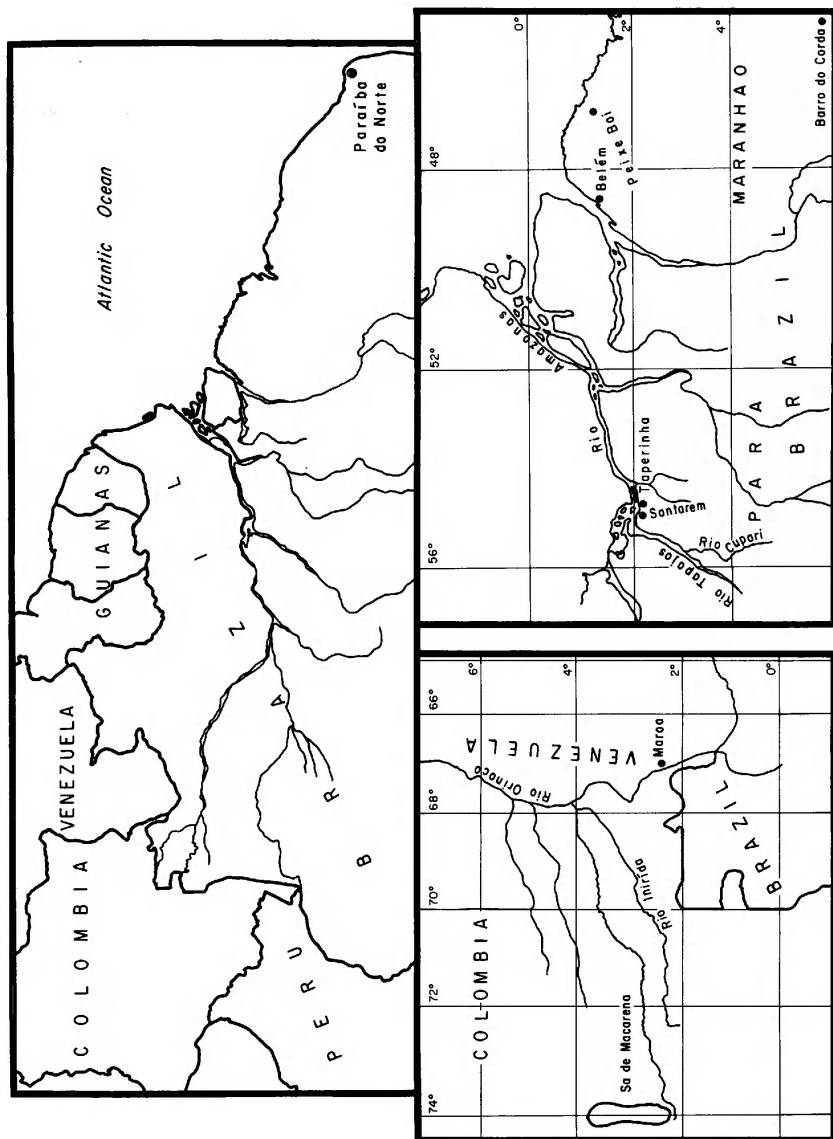


Fig. 1. Sketch map of northeastern South America with two detail maps showing the relation of localities indicated in text.

puzzling genus *Cadea* now endemic on Cuba and the Isle of Pines (Gans and Alexander, 1962). The three Amazonian genera have been previously known from few specimens, *Mesobaena* from the type alone and *Aulura* from only two specimens (Vanzolini, 1948).

A continuing review of the *Amphisbaenia* now permits me to redescribe and illustrate the three forms on the basis of a small series for each. The additional material is here utilized to define the known range and to characterize the variation of external characters; the description of skulls and the generic placement of the forms are the subject of a separate study dealing with the internal structures of these forms. Unfortunately, there is almost no ecological information on these species, and several of the localities are questionable. Some of the data on which the present paper is based have already been made available to J. A. Peters (cf. Peters and Donoso-Barros, 1970). The style of description follows Gans (1966, 1971). With the present paper, it is possible to publish a key to the American genera of *Amphisbaenia*.

ABBREVIATIONS AND ACKNOWLEDGMENTS

The specimens examined come from the collections of the following museums identified by the abbreviations given. We thank the several curators who made the loans possible: AMNH, the American Museum of Natural History (C. M. Bogert and R. G. Zweifel); BM, British Museum (Natural History), London, England (J. C. Battersby and A. G. C. Grandison); CG, Carl Gans collection, Buffalo, N. Y.; DZ, Departamento de Zoologia, Sao Paulo, Brazil (A. S. Rand and P. E. Vanzolini); FMNH, Field Museum of Natural History, Chicago (R. F. Inger and H. Marx); MCZ, Museum of Comparative Zoology, Cambridge (E. E. Williams); MEG, Museo E. Goeldi, Belém, Pará, Brazil (Dalcly de Oliveira Albuquerque); MHNP, Museum National d'Histoire Naturelle, Paris (J. Guibé); MN, Museo Nacional, Rio de Janeiro, Guanabara, Brazil (A. L. de Carvalho); NHMB, Naturhistorisches Museum, Bern (H. Sagesser); NMW, Naturhistorisches Museum zu Wien, Vienna, Austria (J. Eiselt); SMF, Senckenbergische Naturforschende Gesellschaft, Frankfurt a. Main (K. Klemmer). I wish to thank Drs. Federico Medem and J. A. Roze for donating the specimens, Mr. W. C. A. Bokermann for geographical information, Mr. A. L. Stimson for information on the new species of *Anops*, and the members of the 1967 herpetology seminar, particularly Richard B. Graczyk and Barry Haight who reviewed these forms. Messrs. William Oleszko and James Stamos and Dr. Virginia Cummings provided the illustrations. Mr. C. O. d'C. Diefenbach commented on the manuscript.

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KEY TO THE AMERICAN GENERA

1. Two well-developed forelimbs, but no hind limbs (head large and bluntly rounded; an enlarged azygous prefrontal; discrete nasals, preoculars and supraoculars; dorsal and ventral half-annuli poorly aligned along lateral sulci, with dorsal number 50 per cent higher than ventral; precloacal pores in two series, widely separated) *Bipes*
 No external evidence of forelimbs or hind limbs 2
2. Snout shovel-shaped, head with more or less marked horizontal edge; alternating rows of narrowed and wider gular segments or a bare gular fold lacking regular segments 3
 Snout rounded or pointed in dorsal view, or head with a marked vertical keel; gular region covered with regular segments; ventral segments of pectoral region arranged in continuation of the dorsal half-annuli 5
3. Alternating rows of narrowed and wider gular segments; caudal tip dorso-ventrally flattened, its dorsal surface covered with multiple small tubercles *Rhineura*
 A bare gular fold lacking regular segments; caudal tip rounded 4
4. Rostral and nasals fused; one or more medial, azygous shields on the dorsal surface of the head; segments of the pectoral region (annuli 4-15) generally modified, arranged in diagonal pattern or fused into rows; more than two dermal annuli per vertebra; tail without autotomy constriction *Leposternon*
 Rostral and nasals discrete; all shields paired along the dorsal surface of the head; segments of the pectoral region slightly enlarged and modified; two dermal annuli per vertebra; tail with clear autotomy constriction *Aulura*
5. Prefrontal azygous (flanked laterally by a postnasal supraocular segment; dorsal and ventral half-annuli overlap so that the lateral sulci are wide and poorly defined; a single row of medially interrupted precloacal pores; tail lacking autotomy plane; pigmentation pattern involving spots and blotches, more or less independent of the segmental arrangement) *Cadea*
 Prefrontals paired 6
6. Head keel-shaped; rostral enlarged, extending posteriorly, separating nasals, prefrontals, and sometimes frontals, keel occasionally keratinized; caudal autotomy present 7
 Head not keel-shaped; rostral not separating frontals and prefrontals; no caudal autotomy 8
7. Head more pointed than keel-shaped; medium-sized frontals in broad contact on midline; rostral process keratinized in adults; mental in contact with first and second infralabials; two precloacal pores on each side separated by median hiatus; tail tip with doubled vertical ridge *Mesobaena*
 Head highly compressed and keel-shaped; frontals very small and irregular; prefrontals almost entirely separated by rostral; rostral process heavily keratinized in adults; mental in contact with first infralabials only; (two or¹) four precloacal pores in single (medially interrupted) row, their presence and size reflecting sexual dimorphism; tail tip elliptical (with doubled vertical ridge) *Anops*

¹ Statements in parentheses refer to the new species being described by A. L. Stimson.

8. Rostral in broad contact with prefrontals, restricting small nasals to sides of vertically compressed head; two pairs of precloacal pores separated by median hiatus *Bronia*
 Rostral without or with only narrow median contact with prefrontals, unless they have fused with nasals; a variable number of round or oval precloacal pores in single row of precloacal segments without hiatus *Amphisbaena*

GENERIC STATUS

The aim of this series of papers is a reclassification of the *Amphisbaenia*, first characterizing the species and then combining them into an acceptable higher grouping. It seems appropriate to defer most decisions about generic reclassifications until the first level of analysis is complete. As the external patterns of these three genera show some level of difference from one another and those of groupings previously recognized, the groupings are here retained.

Aulura was characterized (Barbour, 1914) by its spatulate head shape, similar to that of the genus *Leposternon*. It was stated to differ from the latter by having separate nasals rather than a fused rostronasal and by having an autotomy annulus (though Barbour, who described it well, did not recognize its function). Vanzolini (1948) amplified the description by noting the highly modified pectoral segments and the gular specialization. Even though *A. anomala* is in many ways intermediate between *Amphisbaena* and *Leposternon*, it seems appropriate to retain the genus for the moment.

Bronia Gray (1865) was described as a distinct genus on the grounds that the nasal shields were separated by a large swollen shield. Few additional characteristics of segmentation geometry are obvious, and Amaral (1935) placed this species in the synonymy of *Amphisbaena v. vermicularis*. Yet the head shape of *Bronia* Gray seems quite distinct, even though it is close to *A. steindachneri* in *Amphisbaena* (to which it is similar by having short frontals and prefrontals, cf. Vanzolini, 1949), so that the genus should be retained. The situation is thus different from that of the genus *Diphalus* Cope (1861) erected only because it lacked contact between the nasals and later placed into synonymy (Gans and Alexander, 1965).

In describing *Mesobaena*, Mertens (1925) emphasized the laterally compressed head, the prognathous snout, the separated nasals, but also associated the species with the family Leposternidae. In a second paper he expanded the concept of *Mesobaena* as an intermediate form in the line *Amphisbaena*, *Bronia*, *Mesobaena*, *Anops*, by noting the remarkable similarity in head shape, particularly to *Cadea palirostrata*. There can be little doubt that the specialization and major differences between *Mesobaena* and all of these other forms justify the retention of the generic designation.

It might be useful to comment briefly on Mertens's (1926) discussion of

segmental homologies. In the original description Mertens (1925) identified the elongate and "preorbital" segments as prefrontals. Later (1926) he agreed with Dickerson (1916) that these were supraoculars so that the prefrontals had been lost by fusion to the rostral.

Homologies in amphisbaenian head scalation have always posed problems (Gans, 1966), but it seems most appropriate to maintain a standardized nomenclature as long as the limited landmarks can be utilized. In this case, we have the landmark of eye and nostril. In *Amphisbaena* and even in the modified *Bronia*, the paired prefrontals occupy the area posterior to the nasal, superior to the second infralabial and anterior to the interocular suture (equal to the anterior limit of the frontals). In *Cadea* in which the nasals are excluded from midline contact, we observe two phenomena: (1) the introduction of a new suture, parallel to the supralabial edge, from the top of the nasal to the middle of the anterior suture of the frontal and (2) the fusion of the old medial suture between the paired prefrontals. Thus the primary pair of prefrontals has first been fused and then subdivided into three segments. All three new segments are now homologous (if one can indeed talk of such a thing) to the paired prefrontals as a whole.

In *Mesobaena* the situation is even more complex because here the division does not parallel that seen in *Cadea*. The rostral has not "fused" with the prefrontals but has displaced them by sending a process up the midline to contact the frontals. Anteriorly the old prefrontals have been restricted medially to the top of the nasals; posteriorly they gradually extend across more of their old area to meet in a three-way point contact with each other and the rostral. This situation is indicative of an earlier stage of the condition in *Anops* (cf. Gans and Rhodes, 1964) in which the rostral ascends to the level of the parietals, and only a double row of variously proportioned segments remains on each side to fill the space between the rostral and the nasal-supralabial-ocular row.¹

GENUS *AULURA* BARBOUR

Aulura BARBOUR, 1914, p. 96 (type species: *Aulura anomala*, by monotypy).

The snout is spatulate with its tip formed by the rostral, followed by pairs of large nasals, prefrontals, and frontals along the dorsal surface of head.

¹ The gap between the conditions found in these two genera is further reduced by the discovery of a yet undescribed species collected some 250 km. north of Xavantina, Mato Grosso, Brazil by the Expedition of the Royal Society of London. Five specimens (of characteristics indicated in parentheses in the key) are (further) characterized by their very high number of body annuli (359-368) and by 17 to 19 dorsal and 18 to 20 ventral segments to the midbody annulus. A. L. Stimson who discovered the specimens while they were being sorted in the British Museum is now describing them.

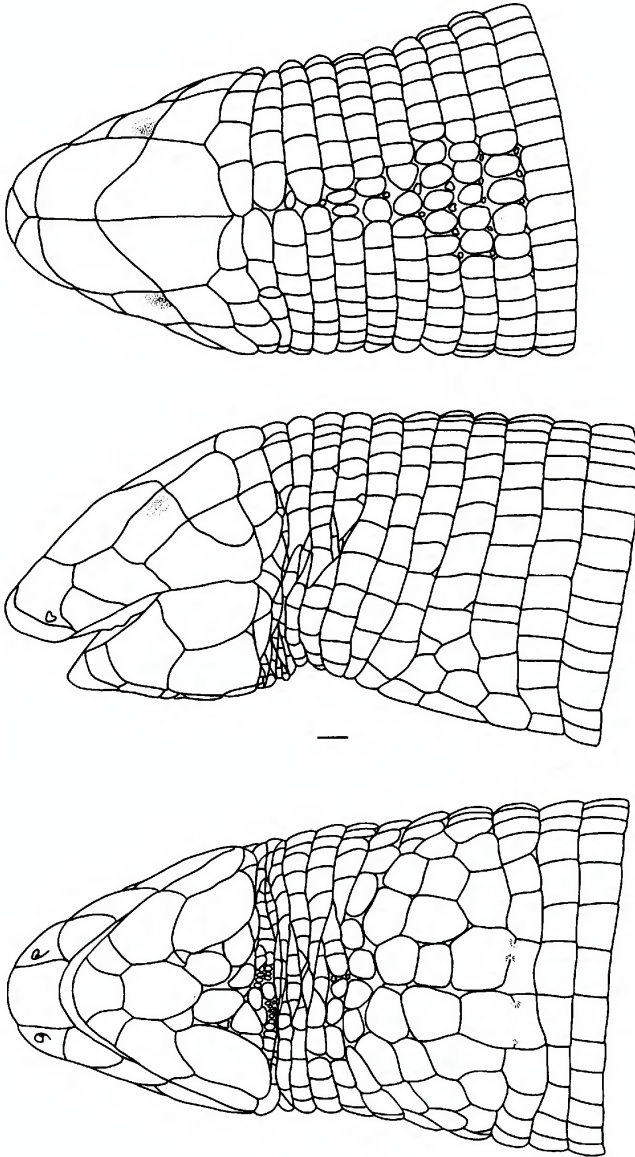


FIG. 2. *Aulura anomala*. Dorsal, lateral, and ventral views of the head of MCZ 4660, the holotype, showing segmental details. Line equals 1 mm. to scale.

The nostrils open on the ventral surface of the snout. The gular region has a nonsegmented fold, the pectoral region shows enlarged segments and

there are two body annuli for each trunk vertebra and one caudal annulus for each caudal vertebra (cf. Alexander and Gans, 1966). There is a very well-defined autotomy annulus, and precloacal pores (scars) lie lateral rather than anterior to the precloacal shield of males (females). The skull has not yet been described.

Aulura anomala Barbour

Aulura anomala BARBOUR, 1914, p. 96 (type locality: "Brazil." Holotype:

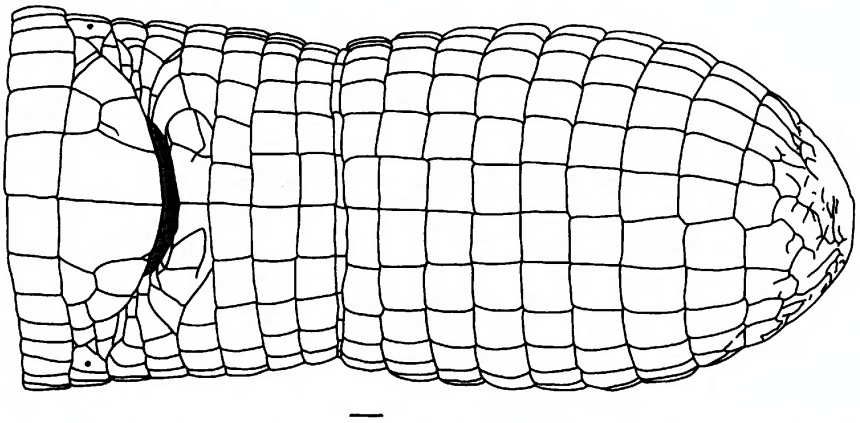


FIG. 3. *Aulura anomala*. Ventral view of cloaca and tail of MCZ 4660 showing segment arrangement. Line equals 1 mm. to scale.

MCZ 4660. Restricted to: "Aura, Município de Belém," Pará, Brazil per Vanzolini, 1948).

DIAGNOSIS: An amphisbaenian with a vertically compressed head, paired cephalic shields posterior to the rostral, an unsegmented gular fold, traces of a pectoral shield, two dermal annuli for each vertebra, a single precloacal pore on each side, and a well-defined autotomy annulus.

DEFINITION: A medium-sized amphisbaenian with a head set off by a narrowed neck from a somewhat thicker trunk and a wide and spatulate snout that forms a sharp anterior edge but is not keratinized. There is a rostral followed by four supralabials on each side, and pairs of nasals, very large prefrontals and large frontals cover the head anterior to the first body annulus. The postgenials are followed immediately by an unsegmented gular fold, posterior to which come some four to five narrow annuli, followed by four or five whose ventral segments are enlarged or fused into a poorly modified pectoral shield. A single precloacal pore or pore scar lies lateral to each end of the precloacal row, and the tail is short and equipped

with a very narrow autotomy site after which it bulges. The dorsal surface bears faintly knobbed segments. There are 182 to 192 body annuli; 13 to 14 caudal annuli; and 16 to 20 dorsal and 18 to 20 ventral segments to a midbody annulus. Dorsal and ventral sulci are absent, but the lateral sulci are very clearly marked. Pigmentation is brown dorsally, lighter ventrally; the segments of the anterior third of the body are evenly pigmented, whereas more posterior ones show concentration in the segmental centers.

NOTES ON THE TYPE: The holotype was collected in Brazil during 1865 by the Thayer expedition and lacks further data. The angulus oris has been cut and the mandibles broken. In spite of Vanzolini's (1948) comment there are strongly marked precloacal pores in this specimen. Vanzolini (1948) selected the female MN 1772 as a lectoallotype, a procedure here interpreted as restricting the type locality to Aura, Pará, Brazil.

DESCRIPTION: Table 1 lists meristic characters. Figures 2 to 6 show details of head segmentation. Figure 17 shows the body proportions.

This is a medium-sized amphisbaenian, most specimens of which are faded. The holotype has the dorsal segments of the body evenly pigmented for the anterior third, the pigment being more concentrated in the segmental centers thereafter so that this region appears darker. The head is dorsoventrally flattened, and the snout roundly spatulate. The lower jaw is relatively deep.

The head segmentation shows no fusions. The rostral occupies a large rectangular area on the ventral exposure of the prognathous snout and sends a triangular portion around the spatulate edge, almost keeping the nasals from contact. The nostril inserts on the ventral surface through the medium-sized nasals that cover the lateral portions of the spatulate edge. They are followed up the convex dorsal surface by the very large, broadly contacting prefrontals and large frontals, the posterior edge of which lies on the level of the angulus oris. Small parietals follow in line. There are four supralabials, the fourth the smallest, the second the largest, or equal to the third. The squarish and large ocular (through which the eye is clearly visible) contacts the second and third of these. The supralabial sutures run anteriorly from the edge of the mouth, but this region faces ventrally rather than straight laterally. The postocular is almost as large as the ocular and followed ventrally by a smaller temporal that butts on the fourth supralabial.

The medium-sized mental occupies a slightly smaller region on the edge of the mouth than does the rostral and swings posteriorly to contact the shield-shaped postmental in a low, straight suture. The postmental is in contact with the small first and large second infralabials. Its lateral edges spread and it may or may not be in contact with the tips of the large malars

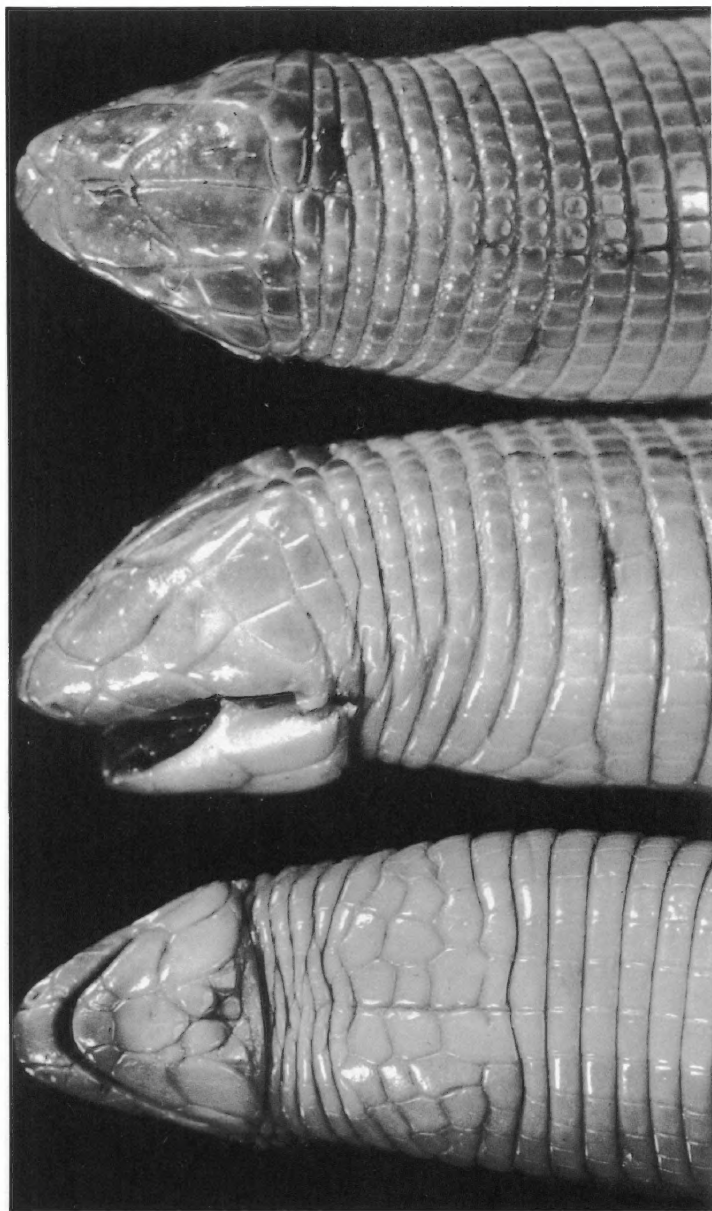


FIG. 4. *Aulura anomala*. Dorsal, lateral, and ventral views of the head of MCZ 4660 to document shape and pigmentation.

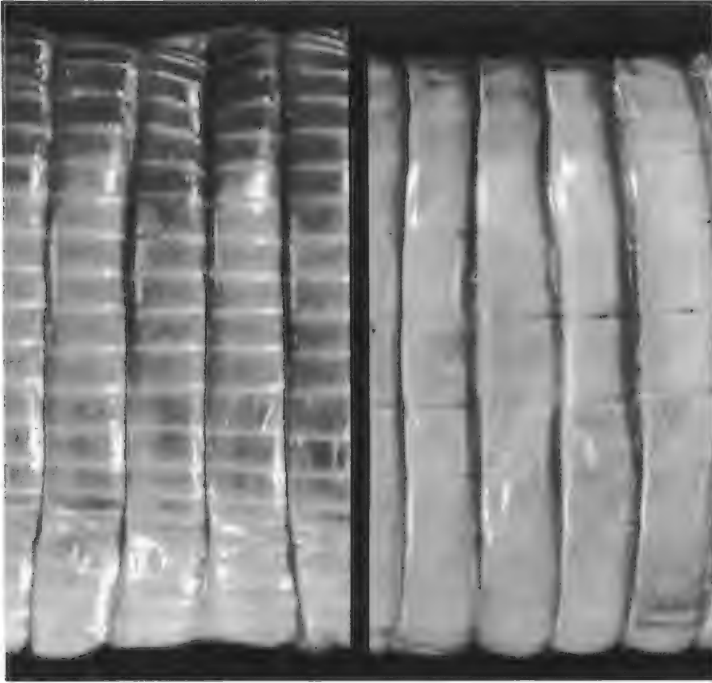


FIG. 5. *Aulura anomala*. Dorsal (left) and ventral (right) view at midbody of MCZ 4660 showing relative size and pigmentation of segments.

that extend posteriorly to the end of the elongated and relatively wide third infralabials. A row of two or three irregularly shaped and often asymmetrical first postgenials is followed by about four postgenials in the second row. The posterior edge of the chin segments is formed by the posterior aspects of the third infralabials, the malars and the second postgenials. A variable gular fold or gap of skin follows the chin segments. It is clearly more flexible, thinner, nonsegmented, and arranged in characteristic folds when the tip of the snout is depressed below the midline of the body (suggesting that this species excavates its tunnels with an upward stroke of the head, similar to the pattern seen in the genera *Leposternon*, *Monopeltis*, and *Tomuropeltis*, cf. Gans, 1968).

Dorsally the first body annulus forms wedge-shaped segments intercalating between the sides of frontals and parietals but often not meeting on the midline; the parietal either forms part of the second body annulus or of an intercalated dorsal half-annulus. The first five body annuli are narrow and the sixth through ninth are ventrally irregular and may include a supernumerary ventral half-annulus with the enlarged and occa-

sionally fused polygonal segments forming a pattern representing a pectoral shield. More posteriorly the annuli lie in a plane normal to the long axis of the body.

There are 182 to 192 body annuli from the back of the fourth infralabial up to and including the row just anterior to the precloacal shield. Few interspersed half-annuli were noted, but there was considerable annular irregularity. At midbody an annulus contains 16 to 20 dorsal and 17 to 20 ventral segments that are generally quite regularly rectangular.

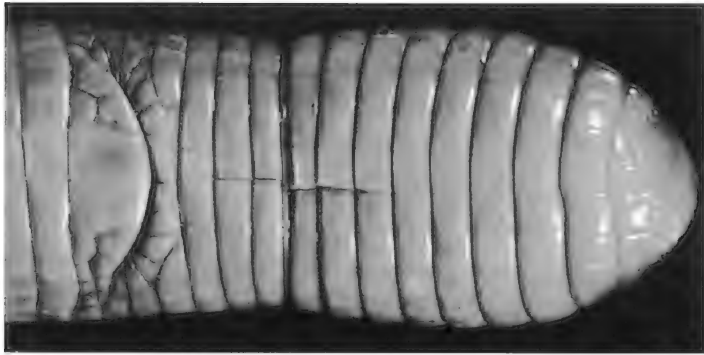


FIG. 6. *Aulura anomala*. Ventral view of cloaca and tail of MCZ 4660 showing pigmentation and segment arrangement.

The male holotype has a well-defined round pore situated central to a segment immediately lateral to each end of the precloacal row, but the cloacal region of most specimens shows only pore scars. Hence there seems to be considerable sexual dimorphism. The cloacal shield is regularly covered by eight segments which decrease drastically from the middle to the sides and are subdivided by a series of sutures that seem to radiate from a point on an annulus posterior to the cloaca. The posterior cloacal lip is formed of 14 to 16 segments, the medial one by far the largest, and the sutures between the lateral ones tending to enter from the sides. Four to six laterals occur.

There are 13 to 14 caudal annuli. The third or fourth postcloacal annulus is only one-quarter the length of the preceding ones. Immediately distal to this the tail becomes significantly wider, curving inward again about the tenth or eleventh caudal annulus and terminating as a pointed structure with a faint lateral compression. More anteriorly the tail shows a depression along the dorsal midline and several of the annuli show irregularities here. The segments of the posterodorsal tips tend to be slightly more

irregular and formed into knobs. The ventral surface of the tail is flat.

The lateral sulci are visible by the tenth but not clearly marked until approximately the fortieth body annulus and continue to the level of the cloaca. At midbody the sulcus is approximately as wide as one segment, and the bottom of the groove is complexly modified by diagonal folding lines.

The middorsal segments are approximately twice as long as wide, whereas the midventral segments are somewhat wider than long.

RANGE: States of Pará and Maranhão, Brazil.

DISTRIBUTION RECORDS: BRAZIL: No data: MCZ 4660 (Holotype *A. anomala* Barbour, 1914; Vanzolini, 1948).

PARÁ: Aurá, near Belém: MN 1772 (Lectotopotype per Vanzolini, 1948; Cunha, 1961). Ananindeua, near Belém: DZ (No. missing); MEG 222; (Cunha, 1961). Município de Peixe Boi (now Nova Timbótena, old Agricultural Station): MEG 223 (now CG 2766); (Cunha, 1961).

MARANHÃO: Barra-do-Corda: BM 1934.5.28.1; (Gans, 1967).

GENUS *BRONIA* GRAY

Bronia GRAY, 1865, p. 448 (type species: *Bronia brasiliiana*, by monotypy).

The prognathous snout is relatively short, pointed, slightly compressed laterally, dorsally convex, and strongly bent. The nasals are small, never contact each other, and are partially fused to the very large rostral. The bluntly conical tail lacks an autotomy plane. Precloacal pores are present. Vanzolini (1951) noted that the skull is "similar to that of *Amphisbaena*" and that the dentition is 7 (premaxilla), 5 (maxilla), and 8 (dentary).

Bronia brasiliiana Gray

Bronia brasiliiana GRAY, 1865, p. 448 (type locality: "Tropical America; Santarem, on the Amazons," Brazil. Holotype: BM 1946.8.31.77).

DIAGNOSIS: An amphisbaenian with a short, rounded head that is slightly compressed laterally. Prefrontals but not nasals (the suture separating these from the rostral may be partially missing) lie in medial contact. There are four round precloacal pores in a medially interrupted row, and caudal autotomy is absent.

DEFINITION: A medium-sized amphisbaenian with a small, short, domed head that shows some lateral compression. The rostral tip of large specimens is faintly keratinized. The rostral covers the prognathous snout. On each side the rostral is flanked by and keeps from medial contact a sometimes but partially separated nasal in which the nostril is pierced so that it faces the lateral aspect of the head. Enormous paired prefrontals are followed by medium-sized frontals. The number of labials is irregular, and

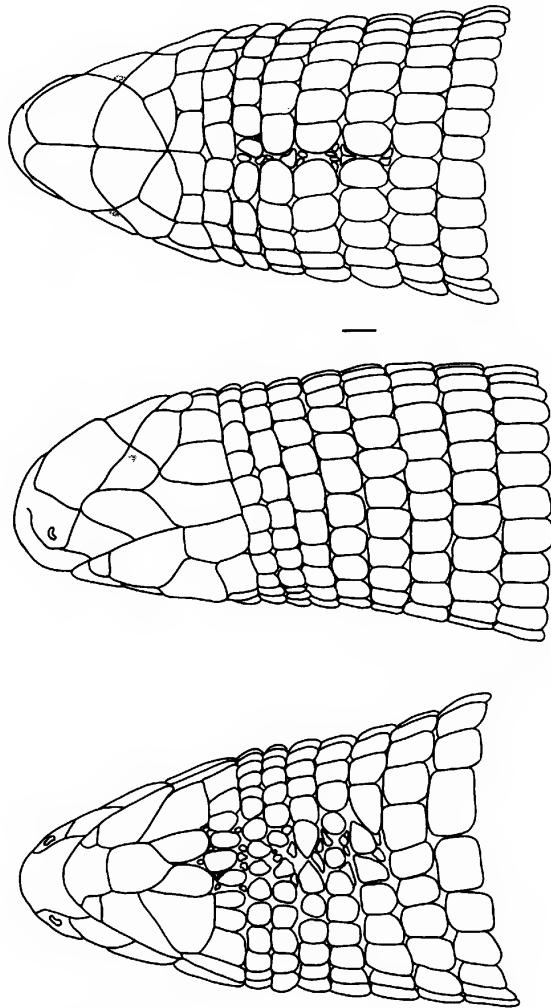


FIG. 7. *Bronia brasiliiana*. Dorsal, lateral, and ventral view of head of NMW 861 showing segment arrangement. Line equals 1 mm. to scale.

there is one postgenial and a postmalar row. Four, small, round precloacal pores are arranged in a medially interrupted row and the tail is blunt and lacks an autotomy constriction. There are 213 to 229 body annuli; 11 to 15 caudal annuli; and 18 to 21 dorsal and 18 to 21 ventral segments to a mid-body annulus. Dorsal and ventral sulci are absent, but the lateral sulci are clearly marked. The dorsal region of body and tail is pigmented in brown, emphasizing the segmental centers, and starting two to three segments

dorsal to the lateral lines.

DESCRIPTION: Table 1 lists meristic characters. Figures 7 to 11 show details of segmentation. Figure 17 shows the body proportions. The sample seems too small to test for geographical variation.

This is a medium-sized amphisbaenian of a brownish dorsal and yellowish ventral coloration in preservatives. Most available specimens had completely faded. A dorsal band of strongly pigmented segments extends

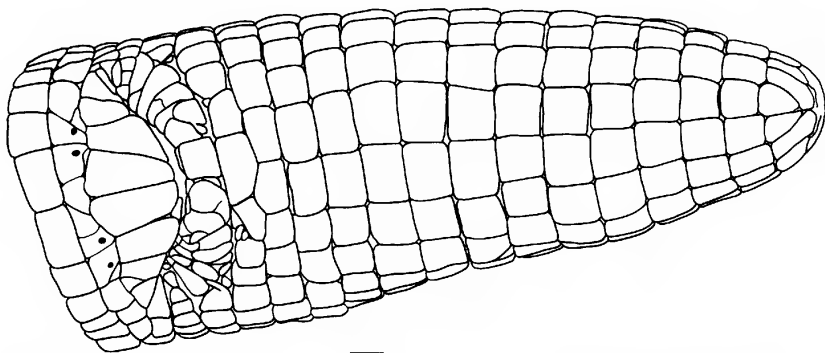


FIG. 8. *Bronia brasiliana*. Ventral view of cloaca and tail of NMW 12346 showing caudal segmentation and placement of precloacal pores. Line equals 1 mm. to scale.

down to two to three segments dorsal to the lateral line, although slight amounts of pigment speckling continue onto the more ventral segments as well. The dorsal segments show a more or less continuous speckling of pigments. Particularly in the anterior third to one-half of the trunk, the segments show a denser pigmentation in a round area within their center. More posteriorly the pigmented area of each segment extends up to each interannular suture, but there tends to be a nonpigmented zone adjacent to (both sides of) the intersegmental sutures. The pigmentation of the dorsal surface of the tail is much denser, and faint pigment here extends ventrally to the level of the lateral sulcus.

The head is short, significantly smaller than the trunk, laterally compressed, and highly domed. The lower jaw is relatively deep.

The dorsal portion of the suture separating the nasal from the rostral tends to be more or less completely fused about 80 per cent of the time. The rostral occupies a very large truncated triangular area on the ventral exposure of the prognathous snout, whereas the tip of the triangle covers the swollen, vertically oval tip to achieve broad contact with the prefrontals and restrict the medium-sized nasals to noncontacting rectangular

TABLE 1
DATA FOR SPECIMENS

Collection and Number	Annuli Body + Lat. + (Aut.) Tail	Midbody Segments		Labials Supra/ Infra	Chin Segments	Cloacal Segments	Length Snout/ vent + tail	Body Diameter
		Dorsal + Ventral						
<i>Aulura anomala</i>								
MCZ 4660	191 + 4 + (4)14	18 + 20		4/3	2(1) + 4 + 0	2 + 8 + 13	256 + 20	9.5
MN 1772	182 + 4 + (4)14	18 + 20		4/3	2 + 4 + 0	0 + 8 + 14	250 + 19	—
MEG 222	183 + 5 + (3)14	19 + 20 + 19 + 20		4/3	3 + 4 + 0	0 + 8 + 14	272 + 23	12
CG 2766	185 + 6 + (4)13	18 + 20		4/3	3 + 4 + 0	(1)0 + 8 + 15	272 + 23	9.5
DZ 7135	186 + 5 + (3)13	16 + 18		4/3	2 + (4) + 0	0 + 8 + 16	273 + 19	12
BM 1934.5.28.1	184 + 4 + (3)14	17 + 18 + 20		4/3	2 + (4) + 0	—	—	—
<i>Bronia brasiliiana</i>								
AMNH 89348	213 + 3 + 15	18 + 20	4/4(3-1/2/3)		2 + 9	4 + 9 + 11	274 + 18	10. +
NMW 861	226 + 2 + 14	20 + 18	3/3		2 + 9	4 + 10 + 10	235 + 15.5	9. -
NMW 12346	225 + 2 + 14	20 + 18	3/3		2 + 7	4 + 8 + 16	260 + 21	9
MHNP A5478A	224 + 2 + 14	20 + 18	3/3		2 + 8	4 + 8 + 13	317 + 20.5	11. +
MHNP A5478B	224 + 2 + 15	20 + 18	3/3		2 + 7	4 + 8 + 12	239 + 17	9
NHMB A589	216 + 3 + 13	20 + 18	4-3/3		2 + 8	4 + 9 + 14	255 + 17.5	9.5
MCZ 2930	220 + 3 + 13	20 + 18	3/3		2 + 9	4 + 10 + 14	176 + 12.5	5
BM 1946.8.31.77	226 + 4 + 12	19 + 21 + 18 + 19	3/3		2 + 7	4 + 10 + 12	264 + 19	9 +
BM 96.6.29.2	226 + 4 + 11	18 + 19 + 18	3/3		2 + 7	4 + 10 + 17	300 + 18	13
BM 1961.1820	228 + 3 + 11	21 + 20 + 21	3/3		2 + 7	4 + 8 + ?	228 + 14	7.5
MCZ 2782	229 + 2 + 14	20 + 20	3/3		2 + 8	4 + 9 + 12	287 + 20	11 +
MCZ 2817	217 + 2 + 14	18 + 20	3/2-1/2		2 + 9	4 + 8 + 11	207 + 16	8.5
BM RR1968.850	227 +	20 + 1 + 20	3/3		2(1) + 8	4 + 8 + 15	255 + 17	9
MCZ 36945	223 + 4 + 12	20 + 18	3-4/3		2 + 9	4 + 9 + 15	310 + 21	12.5

TABLE 1 — (Continued)

Collection and Number	Annuli Body+Lat.+ (Aut.) Tail	Midbody Segments Dorsal+ Ventral	Labials Supra/ Infra	Chin Segments	Cloacal Segments	Length Snout/ vent+tail	Body Diameter
<i>Mesobaena huebneri</i>							
SMF 11829	281+4+(6)16	12+14	3/3	2+5+7	3+6+	232+18	6.0
FMNH 130987	268+2+(6)17	13+14	2-1/2/3	2+4+5	4+8+11	118+10	3.5
CG 4786	272+3+(6)17	13+15	3/3	3+5+9	—	?207+18	4.5
AMNH 104641	259+4+(6)17	14+12	3/3	2+4+6	4+16+17	108+10	3.2
CG 4787	258+3+(6)17	14+15	3/3	2+4+5	4+8+15	239+18	8.0

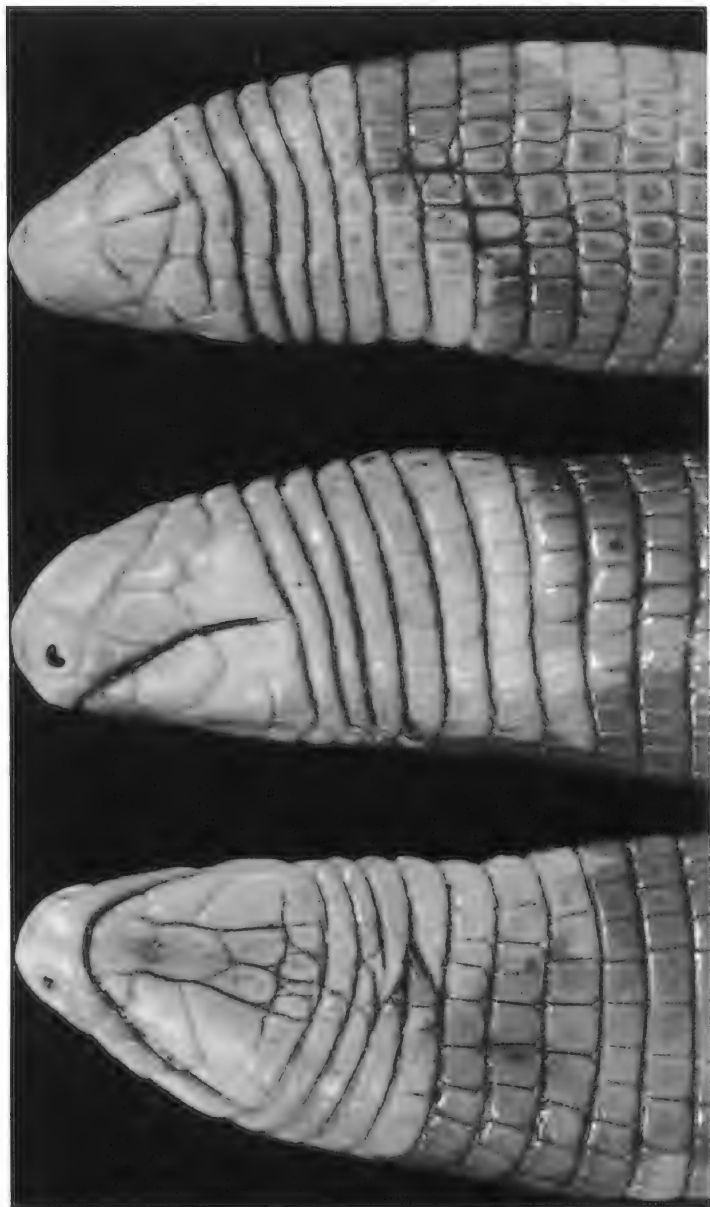


FIG. 9. *Bronia brasiliana*. Dorsal, lateral, and ventral views of the head of NMW 12346 to document shape and pigmentation.

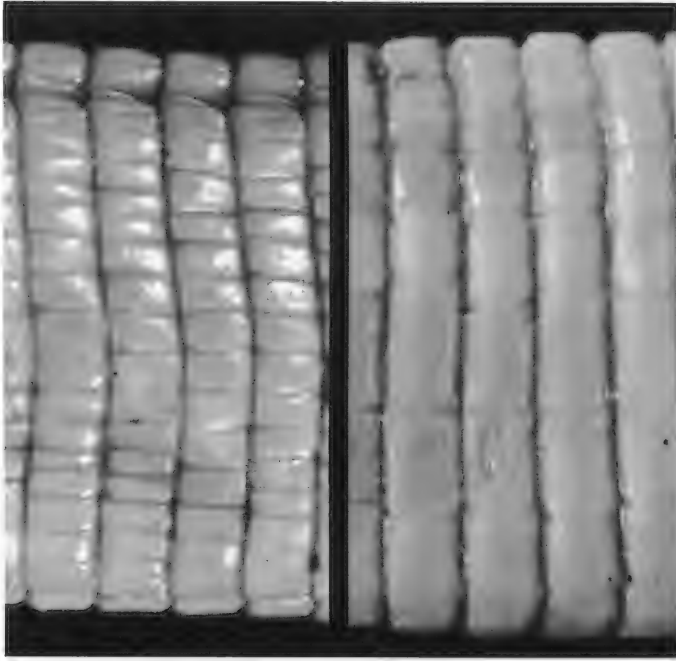


FIG. 10. *Bronia brasiliiana*. Dorsal (left) and ventral (right) view at midbody of NMW 12346 showing relative size and pigmentation of segments.

areas on the sides of the head. The nasals hold the laterally exposed nostrils. The edge of the nasals is in broad contact with the dorsal edge of the first infralabial and in narrow contact with the anterior portion of the second infralabial. The prefrontals are enormous and each forms a characteristic, posteriorly concave suture, respectively with the rostronasal region and the small subtriangular frontals. The lateral edges of the prefrontals contact the anterodorsal edge of the second supralabial and the ocular. The angulus oris lies between one and two annuli posterior to the posterior edge of the frontals.

The inter-supralabial sutures run anteriorly at angles of 45 degrees or less to the long axis of the animal. The first supralabial is the smallest, dorsally contacting only the nasal and posteriorly contacting the second, which is the largest. The third supralabial may extend beyond the poorly defined angulus oris; its posterior tip is sometimes divided off by an anteriorly slanted or vertical suture to form a fourth supralabial (or post-supralabial).

The head scalation is well defined because the interannular suture

defining the back of the last supralabial (postsupralabial) extends normal to the long axis of the animal. The next more anterior row of segments includes two segments in posterior contact with the ocular (the eye is invisible in all specimens). The ventralmost postocular is horizontal, lying immediately dorsal to the supralabial; the second and even more complexly polygonal one follows anterodorsally, in much broader contact with ocular and frontals. One to three segments ordinarily lie dorsal to each of these postoculars. Of these the more medial ones are by far the smallest so

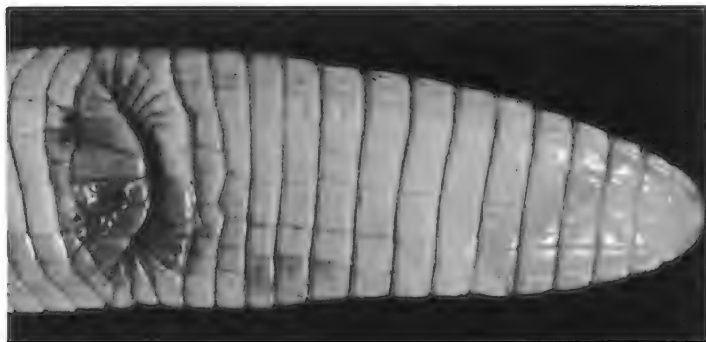


FIG. 11. *Bronia brasiliiana*. Ventral view of cloaca and tail of NMW 12346 showing pigmentation and segment arrangement.

that the parietal region is filled with segments that are significantly smaller, rather than larger, than the segments of body annuli. Occasionally one sees specimens in which some of these segments have obviously been fused to the posterior tip of the frontal.

The rostral (but not the nasal), and particularly the medial surfaces of the prefrontal and frontal, tend to be faintly keratinized with the degree of such covering increasing with the absolute size of the specimens.

The medium-sized mental occupies a significantly smaller portion of the labial edge than does the ventrally flaring rostral. In one specimen (MHNB A589) the suture between mental and first infralabial is fused. Laterally the mental is in contact with the dorsal edge of the very small first and the anterolateral edge of the large second infralabial. The latter extends posteriorly past the straight suture between the mental and the shield-shaped postmental, whose posterior aspect is enclosed between two, large, tear-drop-shaped segments of the postgenial row. The very large malars share a significant contact with the lateral edge of the postmalar shield; laterally they stretch along the second infralabial to contact the anteromedial (actually anteroventral) edge of the third. A row of seven to nine postmalar

segments, the lateralmost by far the largest, lies between the posterior wings of the third infralabial. Depending upon the definition of the angulus oris, this row could be considered (but has not been counted) as the first body annulus.

The first two body annuli are significantly narrower; the next three correspond to a markedly narrowed ventral zone. Those following thereafter are less irregular although portions of the anterolateral segments show a tendency to rounding of the segmental corners, particularly along their posterior edges. There are 213 to 229 body annuli from the back of the third infralabial up to and including the row bearing the precloacal pores. Intercalations or irregularities were noted mainly in the annuli along the last third of the trunk. At midbody each annulus contains 18 to 21 dorsal and 18 to 21 ventral segments which are generally quite rectangular.

There are four, small, round precloacal pores arranged in two groups of two with a medial diastema. The diastema may either be formed of a separate azygous non-pore-bearing segment or segments or again the medial segments of the pore-bearing row (and perhaps the one anterior to it) may be significantly wider than those of annuli anterior to these and the pores expressed in the posterolateral corners of the segments.

The cloacal shield is regular and covered by eight to 10 segments, decreasing in size from the medial pair and separated by more or less parallel sutures. The posterior cloacal lip is formed of 10 through 17 segments, the medial ones being the largest although often horizontally split, whereas the sutures between those that are lateral tend to enter the cloacal slit from the sides. Two to four rows of lateral annuli are noted.

There are 11 to 15 caudal annuli. The first two or so are slightly narrowed after which they stay at approximately the same length up to the rounded caudal tip, which is covered by the semi-irregular segments of the last annulus.

The tail lacks any indication of a caudal autotomy site. The dorsal midline is depressed near the caudal base, and here the tail is horizontally oval although its ventral surface is more or less flat up to the distal tip. On or about the eighth caudal annulus, the tail becomes vertically oval and continues this way up to the rounded and laterally compressed distal tip. Superficially the tail appears short and rounded.

The lateral sulci are visible after about the fortieth but are not clearly marked until the sixtieth body annulus whence they continue up to the level of the cloaca. At midbody a sulcus is slightly narrower than a single segment, whereas the adjacent segments tend to be rounded off by diagonal folding lines.

The middorsal segments are approximately one and one-half times as

long as wide, and the midventral segments are somewhat wider than one and one-half times as wide as long.

RANGE: Right bank of Lower Amazon, from Santarem, perhaps to Belém. Only one specimen of the species seems to have been taken during the last half century.

DISTRIBUTION RECORDS: BRAZIL: No data: AMNH 89348; NMW 861,12346; (Gray, 1873). "Amazon River": MHNP A5478A-A5478B.

PARÁ: Belém: DZ 7137; NHMB A589. Taperinha, right bank of Amazon, 50 km. east from Santarem: MCZ 2930. Santarem: BM 1946.-8.31.77 (Holotype collected by H. W. Bates; Gray, 1865, 1872, 1873; Boulenger, 1885), 96.6.29.2, 1961.1820; MCZ 2782, 2817; MHNP A5343 (Strauch, 1881). Cuparia = Cupari River (cf. Bates, 1892); BM RR1908.-850 (Boulenger, 1885; Strauch, 1881). Pinary, Amazon River (not located): MCZ 36945.

PARAIBA: Parahyba do Norte: (Sclater, 1880). (This questionable record, as well as that of Beddard, 1905, is based on an entry in the catalog of the London Zoo. The specimen does not appear to have been preserved.)

NOTES ON BIOLOGY: Flower (1925) noted that a specimen lived for one year, two months and four days in the London Zoological Gardens. BM 1961.1820 from Santarem is marked "killed in garden in morning." Beddard (1905) discussed visceral vasculature and mesenteries.

GENUS *MESOBAENA* MERTENS

Mesobaena MERTENS, 1925, p. 170 (type species: *Mesobaena huebneri*, by original designation).

The prognathous snout is highly elongate, as well as pointed and laterally compressed. Enlarged shields cover it for some distance beyond the angulus oris. The nasals are large and elongate, and lie on the sides of the head so that the nostrils open lateroventrally. The prefrontals are large and in point-contact with each other. The rostral is very large and ascends the full height of the face so that its posterior tip contacts or approximates the level of the triangular frontal tip that reaches beyond the interocular line. The bluntly conical tail has a poorly marked autotomy annulus, and shows a doubled vertical keel on its distal surface. There are four precloacal pores, arranged in two pairs.

Mesobaena huebneri Mertens

Amphisbaena huebneri BOETTGER in Anon., 1896, p. lv (*nomen nudum*, cf. Mertens, 1925, p. 171).

Mesobaena huebneri MERTENS, 1925, p. 170 (type locality: "Inirída, Süd-Venezuela" = Colombia. Holotype: SMF 11829 (formerly No. 5450,2a).

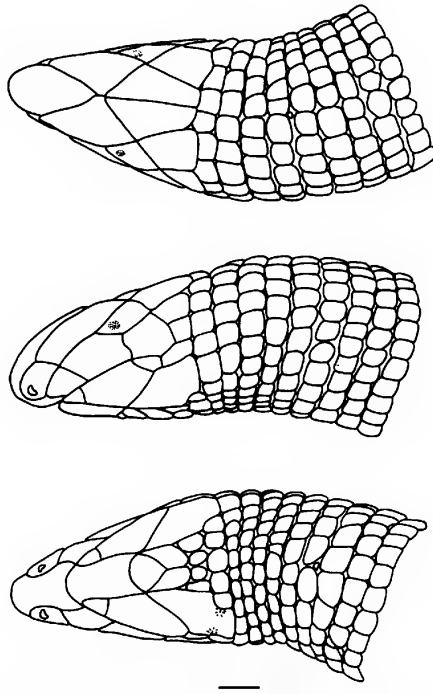


FIG. 12. *Mesobaena huebneri*. Dorsal, lateral, and ventral views of head of FMNH 130987 showing segment arrangement. Line equals 1 mm. to scale.

DIAGNOSIS: An amphisbaenian with a very elongate, highly domed head and enormous rostral which prevents the nasals and most of the prefrontals from medial contact. The frontals extend significantly beyond the level of the angulus oris. The species has a single, uninterrupted row of four precloacal pores and a poorly marked autotomy constriction.

DEFINITION: A small to medium-sized amphisbaenian with a very elongate, highly domed head and a laterally compressed prognathous snout that is covered by the rostral. Rostral tip and dorsal aspect of large specimens are markedly keratinized. The rostral is flanked by the nasals and the elongate and very large prefrontals on each side keeping the latter from more than point contact on the midline. The nostrils face lateroventrally. There are (ordinarily) three supralabials and three infralabials, the last in each case extending significantly beyond the angulus oris. The frontals are paired and triangular, their posterior tip reaching beyond the level of the angulus oris; the oculars are large, and there is a single even larger temporal on each side. The mental is twice as long as the postmental, and the

second infralabial is the largest segment on the chin. There are three post-genial rows. Four, small, round precloacal pores lie in an interrupted row on the anterolateral corners of each segment of two pairs, that are positioned just anterior to the wings of the precloacal shields. The bluntly conical tail has a poorly marked autotomy annulus at the sixth caudal annulus and terminates in an unsegmented, produced, doubled vertical keel. There are 259 to 283 body annuli; 17 to 19 caudal annuli; and 12 to 14 dorsal and 12 to 15 ventral segments to a midbody annulus. Ventral sulci are absent but the dorsal and lateral sulci are clearly marked. The

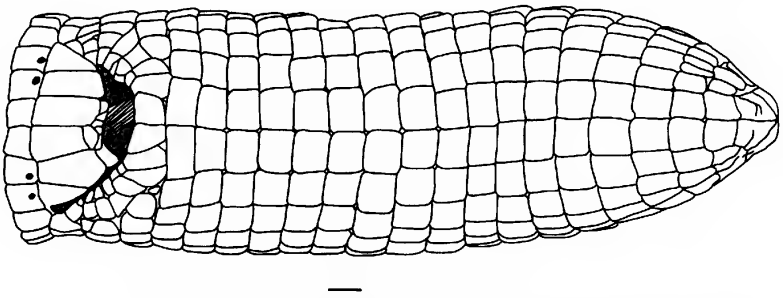


FIG. 13. *Mesobaena heubneri*. Ventral view of tail of CG 4787 showing segment arrangement and pore placement. Line equals 1 mm. to scale.

dorsal segments bear sharply defined, very dark spots that extend ventrad to the level of the lateral line, except that the head is clear and the ventral surface of the tail is also pigmented.

GEOGRAPHICAL VARIATION: The sample is hardly adequate to justify consideration of this topic. Yet the three localities exhibit a decreasing cline in number of body annuli going from west to east. The three specimens from Colombia furthermore show one or two segments divided off the posterior aspect of the two third labials so that variably long third supralabials and infralabials are connected by two or three discrete segments rather than four as in both specimens from Venezuela. Finally, the Venezuelan specimens have the lateral segments of the second postgenial row very elongated to extend parallel to the first row.

DESCRIPTION: Table 1 lists meristic characters. Figures 12 to 16 show details of segmentation. Figure 17 shows the body proportions.

This is a small to medium-sized amphisbaenian. The head seems to be but lightly pigmented if at all; the trunk is brown dorsally and yellowish below the lateral sulci, whereas the tail is darkly pigmented on all its surfaces to within one caudal annulus of the cloacal cap. Anterior segments



FIG. 14. *Mesobaena huebneri*. Dorsal, lateral, and ventral views of the head of CG 4787 to document shape and pigmentation.

show dense pigmentation in the segmental centers. More posteriorly, particularly on the dorsal surface of the tail, the entire surface of each segment may be densely pigmented and may even show a round and seemingly depressed central zone of very intense pigmentation. In the holotype the pigmentation is weaker and even lacking in the anteriormost 15 per cent of the trunk.

The head is pointed, and the prognathous snout is laterally compressed so that a keel with its anteriormost aspect just above the level of the nostrils rises in a convex curve to the top of the head. The lower jaw is wide and relatively shallow, the nuchal region of the same diameter as the head and the anterior portion of the trunk (posterior to the sixth annulus) significantly thickened.

The head segmentation shows no fusions. The rostral is the largest segment on the head. It occupies a wide area on the upper lip, then narrows to cover the tip of the snout and ascends almost to point contact with the anterior tips of the frontals. Its surface is keratinized in adults. Lateral to it lie the elongate, lozenge-shaped nasals, into the anterior quadrant of which the nostrils insert, and whose posterior tip is in point contact with the second supralabials. Each nasal is in broad contact with a prefrontal, that may be in point contact just anterior to the frontals, or excluded from such contact by a junction between rostral and frontals. The frontals are large and of the shape of two isosceles right triangles with their bases in contact, although the anterior sutures are concavely scalloped along each midline, whereas the posterior sutures curve convexly. The posterior tips of the frontals touch the first (probably the second) complete body annulus. The lateral edge of the prefrontal contacts the medial edge of the nasal and the dorsal edges of the second supralabial, as well as that of the large ocular.

The position of the frontals is hence slightly anomalous. Their anterior sutures with the prefrontals stretch somewhat anterior to the line between the eyes (or oculars) ordinarily a good guide to their position in amphisbaenian genera. The posterior edges of the frontals reach considerably beyond the level of the angulus oris, another landmark for defining their limits. The latter modification is but a symptom of the general increase in the fraction of the cephalic region covered by enlarged shields; thus the segments of the annulus back of the angulus oris broadly contact the parietals.

There are three supralabials, the first the smallest, the second the largest, but the third often extends beyond the angulus oris and may even fuse with the very small third infralabial (see Geographical Variation). A small triangular segment lies immediately dorsal to the posterior portion

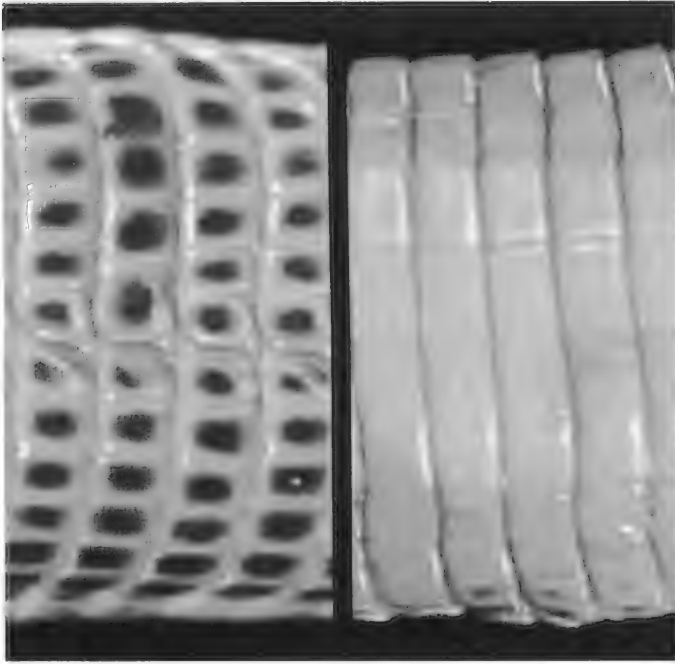


FIG. 15. *Mesobaena huebneri*. Dorsal (left) and ventral (right) view at midbody of CG 4787 showing relative size and pigmentation of segments.

of the third infralabial; immediately dorsal to it is a very large quadrangular scale in a postocular position. The latter is out of contact with the one on the opposite side and completes the coverage of the cephalic region by large shields. The first two supralabial sutures run sharply forward, and the third ascends normal to the angle of the mouth to contact the bottom of the ocular.

The mental is very long. From a contact zone with the tip of the lower edge of the jaw slightly smaller than that of the rostral it sends a long process posteriorly to the postmental. The process is flanked by the small first infralabial and most of the medial edge of the enormous second infralabials. The postmental is very small, its anterior half semicircular, whereas two straight sutures run posteriorly from its sides to join in a 60 degree angle. The postmental is in broad contact with a concave mental tip and in narrow contact with the second infralabials. It may be in point contact with the tips of the large malars and enfolded posteriorly by two (once by three) elongate segments of the first postgenial row. A second postgenial row has much smaller segments that may extend between the

first row and the malars. A third postgenial row marks the end of the cephalic segmentation; its lateralmost segments are clearly notched out of the posteromedial corners of the very large malars, which extend posteriorly to define the edge of the cephalic region of enlarged segments.

The first body annulus is defined as that immediately contacting the angulus oris, therefore one might consider (but I have not counted) that the first and second body annuli have fused to the malars, and the first annulus ventrally visible in this species is the second or the third. The segments of the first three body annuli are laterally narrowed and curved,

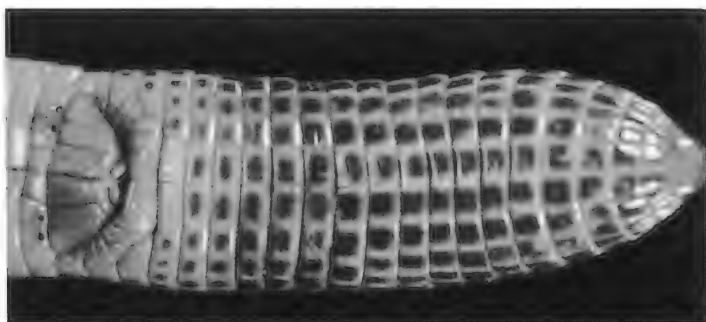


FIG. 16. *Mesobaena huebneri*. Ventral view of cloaca and tail of CG 4787 showing pigmentation and segment arrangement.

whereas the ventrally placed segments of the first five are narrowed. The medial segments of the annuli immediately following thereupon are enlarged. The intersegmental sutures between the segments of the first nine annuli appear to radiate outward in a posteriorly open angle. The segments of more posterior annuli are rectangular. The lateral portions of the first five annuli curve in an anteriorly concave fashion. Thereafter, annuli lie in a plane normal to the long axis of the body.

There are 258 to 281 body annuli (see Geographical Variation) from the back of the fourth infralabial up to and including the row just anterior to the precloacal shield. No interspersed half-annuli were noted and irregularities were restricted to the region just anterior to the cloaca. At midbody an annulus contains 12 to 14 dorsal and 12 to 15 ventral segments which are generally quite regularly rectangular.

The precloacal row contains six rectangular segments, the lateral two on each side bearing small round pores in the posterolateral corners. (The holotype has only three precloacal pores). The cloacal shield is regularly subdivided into about eight shields. The posterior cloacal lip is formed of 11 through 17 segments more or less radially arranged with the medial

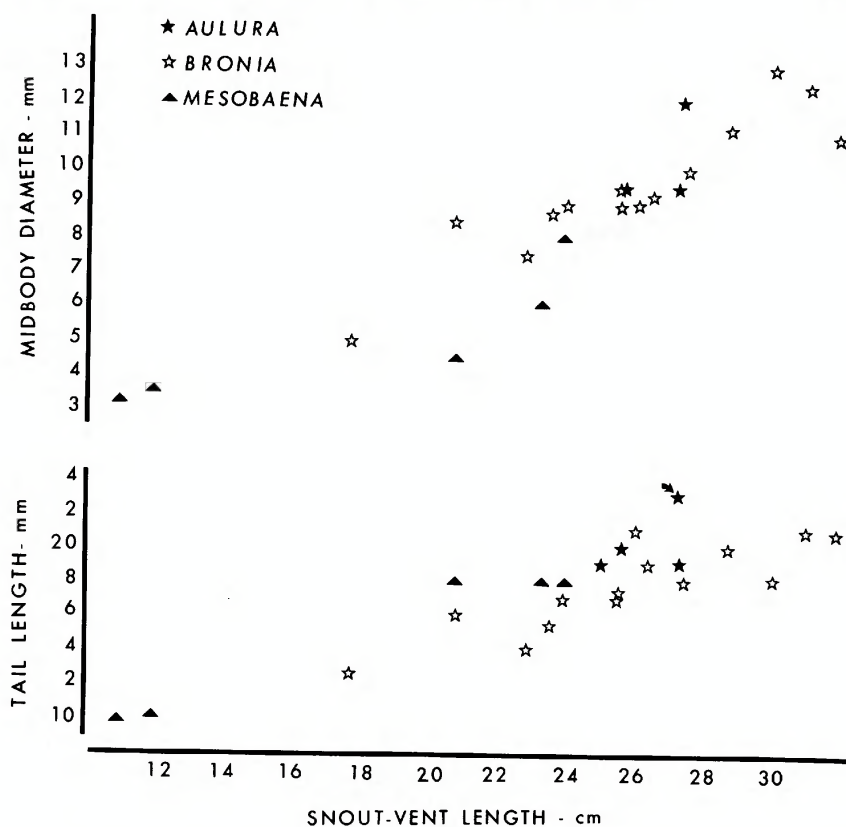


FIG. 17. Scatter diagrams showing relative tail length and midbody diameter for the three species discussed.

ones by far the largest. Two to four laterals occur.

There are 16 to 17 caudal annuli. The sixth postcloacal annulus tends to be slightly more deeply pigmented and otherwise modified, and the skin splits regularly along its edge justifying its definition as an autotomy site. Along its base, the tail is ventrally flat and shows the standard depression along the dorsoventral midline; after the autotomy level, its dorsal surface rises so that it is almost as tall as wide. Its sides gradually narrow over the last five annuli, and the distal tip is formed of a vertical, unsegmented double keel adjoined immediately by the last caudal annulus.

The dorsal and lateral sulci are visible by about the fortieth body annulus and continue to the level of the cloaca. The dorsal sulcus is marked by division of anterior and then posterior corners off the fringing segments. It is only slightly wider than a normal intersegmental raphe. The lateral

sulci are much deeper and more complex. At midbody each sulcus is approximately as wide as one of its fringing segments, modified by diagonal folding lines, and filled with several rows of small irregular segments.

The middorsal segments are approximately one and one-half to one and one-quarter as long as wide. The medial midventral segments are almost twice as wide as long.

RANGE: Amazonian Colombia and Venezuela.

DISTRIBUTION RECORDS: COLOMBIA: Inirída: SMF 11829 (Holotype *M. huebneri* Mertens, 1925, 1926). Meta, Serrania de la Macarena: CG 4786. La Macarena, southern slope, river bank of the Rio Guayabero (taken by Padre Antonio Olivares from the stomach of a raptor, *Belonopteris cayennensis*): FMNH 130,987.

VENEZUELA: Maroa, Territorio Federal Amazonas (landing on Guania River, 320 km. south of Puerto Ayacucho, in tropical rainforest): AMNH 104,641; CG 4787.

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